Computing Education for Intercultural Learning: Lessons from the Nairobi Play Project

IAN ARAWJO, Cornell University, USA
ARIAM MOGOS, Nairobi Play Project, Kenya
STEVEN J. JACKSON, Cornell University, USA
TAPAN PARIKH, Cornell University, USA
KENTARO TOYAMA, University of Michigan, USA

This paper explores computing education as a potential site for intercultural learning and encounter in post-conflict environments. It reports on ethnographic fieldwork from the Nairobi Play Project, a constructionist educational program serving adolescents aged 14-18 in urban and rural multi-ethnic refugee communities in Kenya. While the program offers programming and game design instruction, an equal goal is to foster interaction, collaboration, dialogue and understanding across cultural backgrounds. Based on fieldwork from two project cycles involving 5 after-school classes of 12-24 students each, we describe key *affordances* for encounter, important *resistances* to be managed or overcome, and emergent *complications* in the execution of such programs. We argue that many important accomplishments of intercultural learning occur through moments of friction, breakdowns, and gaps – for example, technical challenges that produce sites of shared humour; frictions between intercultural activities and computing activities; acts of disrupting order; and unstructured time that students collaboratively fill in. We also describe significant complications in such programs, including pressures to adopt norms and practices consistent with dominant or majority cultures, and instances of intercultural bonding over artefacts with xenophobic themes. We reflect on the implications of these phenomena for the design of future programs that use computing as a backbone for intercultural learning or diversity and inclusion efforts in CSCW, ICTD, and allied fields of work.

CCS Concepts: • **Social and professional topics** → *Computing education*; • **Applied computing** → *Collaborative learning*.

Additional Key Words and Phrases: Computing Education; Culture; Collaboration; Constructionism; Conflict; Kenya; Africa; Young Learners; Refugee; HCI4D

ACM Reference Format:
Ian Arawjo, Ariam Mogos, Steven J. Jackson, Tapan Parikh, and Kentaro Toyama. 2019. Computing Education for Intercultural Learning: Lessons from the Nairobi Play Project. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW, Article 52 (November 2019), 24 pages. https://doi.org/10.1145/3359154

1 INTRODUCTION

World conflicts both express and create tensions across cultures, religions, politics, and identities. One way to address these rifts is through education and dialogue [99]. However, bridging difference in entrenched conflict often requires a strategy of indirection that distracts, at least initially, from

Authors' addresses: Ian Arawjo, Cornell University, Ithaca NY, USA, iaa32@cornell.edu; Ariam Mogos, Nairobi Play Project, Nairobi, Kenya, ariam@nairobiplay.org; Steven J. Jackson, Cornell University, USA, sjj54@cornell.edu; Tapan Parikh, Cornell University, USA, tsp53@cornell.edu; Kentaro Toyama, University of Michigan, Ann Arbor MD, USA, toyama@umich.edu.

2573-0142/2019/11-ART52 $15.00
https://doi.org/10.1145/3359154

underlying tensions and mistrust. In business negotiations and international diplomacy, such strategies are sometimes called 'confidence-building measures' [4, 69]. In civil society, there are efforts around the world to bring people of different communities together through activities ranging from sports [107] and writing [9] to board games [82] and the arts [133].

We consider the potential of computing education as a site for intercultural learning. Computing activities can allow for interaction, expression of personal experience, and collaboration – exactly the elements that, if directed well, might lead to familiarity, empathy and understanding. They can leverage shared pragmatic interests (e.g., toward future employment) in the service of broader cultural understanding. Yet while in North American and European contexts computing education is increasingly accompanied by calls for diversity and inclusion [97], the considerable work in this area tends to focus on specific axes of difference, defined for example by gender [72, 124], race [33, 71, 134], ability [52], or socioeconomic status [8, 105], usually emphasizing issues of access or participation for underserved groups [97]. Relatively less attention has gone to considering computing education as a site for intercultural learning, including under conditions of entrenched cultural and geopolitical conflict.

In this paper, we report findings from an ethnographic study of the Nairobi Play Project (NPP), a program that uses introductory programming and game development to support intercultural learning across lines of language, ethnicity, nationality and religion for youth in refugee communities in Kenya [76]. Refugee communities contain different groups, some with long-standing conflicts with one another, offering a special challenge to intercultural learning efforts. To study NPP in a manner that respects contingency and complexity, we applied ethnographic and grounded theory methods [19, 38] across two program cycles and five deployment sites, involving handwritten fieldnotes, semi-structured interviews with teachers and students, photos and documentary material, and iterative thematic analysis. These chosen methods, the constraints of research with this population, and our positionalities as cultural outsiders to the communities of study also posed challenges to this work, which we will expand upon in Methodology and Discussion. Ultimately, our findings coalesce around three broad questions, inspired by activity theory [57] and the field of educational innovations [64]:

(1) **Affordances.** Do common computing activities or practices, hardware or software, present distinct affordances for mediating intercultural learning and encounter?
(2) **Resistances.** What resistances emerged to intercultural engagement – cultural, material, infrastructural – that may nonetheless present opportunities for intercultural learning?
(3) **Complications.** Are there aspects of the above that complicate normative accounts of intercultural outcomes, even when the program design is being executed accordingly?

Our findings complicate narratives that presume a smooth and linear relationship between structured program design, access to resources, and improved intercultural learning outcomes ("if we just had more X - better software, one-to-one computers, better internet connections, etc. - outcomes would improve"). Rather, we found that many moments of intercultural learning emerge not in spite of gaps, frictions, or breakdowns among participants, resources, and program goals, but because of them. Building on themes in cultural psychology and constructionist pedagogy [23, 47, 56], our work thus suggests a delicate and artful balancing act: too much structure and emergent opportunities for learning may be suffocated and squandered; not enough and classes may remain fractured and contentious. This finding echoes long-standing CSCW findings on articulation and coordination work in knowledge-work environments [102, 108, 109] and aligns with recent work in the anthropology of global connections which finds that "...misunderstandings –far from producing conflict –[allow people] to work together," and that "[c]ultural diversity brings a creative friction to global connections" which generates insights and sparks novel paths forward [119, p. x].

Major affordances of computing education for intercultural learning include how computers can motivate diverse participation; how activities can provide fuel for shared humour, especially in the face of communication breakdowns; and how perspective-taking aspects of computational thinking align with empathy-building activities. We trace resistances at multiple levels, yet show how many also presented opportunities for intercultural efforts, including how acts of disrupting order appeared to help students to reflect on their mindsets, and how caring behaviors of participants repaired unplanned breakdowns. Finally, we demonstrate that these moments nevertheless hinge on the built-in diversity of classes and teacher capacity, and that even when diversity is present and the program design is executed accordingly, complications may also arise that involve the shared creation of xenophobic media and pressures to conform with the norms and practices of dominant cultures. We begin by situating our study within relevant literature, provide an overview of the Kenyan refugee context, introduce the reader to the program design and detail our methodology.

2 RELATED WORK

The term "intercultural" appears in a number of contexts, preceding a variety of possible nouns – sensitivity [11], competence [83], capability [7], dialogue, understanding, etc. As deployed here, *intercultural learning* refers to a broad class of positive learning outcomes that might arise from cross-cultural interaction: awareness of differences; tolerance and respect for other ways of being; ability to work with different groups of people; and the exchange of personal experiences and making of friends across traditional social group lines. This is consistent with sociologist Milton Bennett's definition of intercultural learning as oriented around sensitivity and competence [12], though with less emphasis on cognitive cultural intelligence, such as might be gained from foreign language or diplomacy classes. Rather – as in the field of peace education [99] – we consider forms of intercultural learning that occur at structured and purposeful sites of encounter, interaction, bonding, and exchange. Intercultural learning in our usage therefore includes but goes beyond the mere act of encounter with cultural others.

While our research draws on and may contribute to several bodies of work (critical pedagogy [53, 63, 123], digital storytelling and culturally responsive computing [48, 93, 104], and a growing body of HCI work in and around refugee communities [42, 81, 111, 113]), our focus in this paper is on computing education as a potential site and moment of intercultural learning, and is therefore situated in prior work in diversity and educational technology, computing education, and intergroup contact theory. Important grounding for our work is provided by a body of early work in CSCW and CSCL that applied cultural-historical activity theory [57] (CHAT) to the design of educational innovations involving technology. Pioneered by Russian psychologists Vygostky and Leont'ev, and extended by scholars such as Engeström [39], Cole [23], and Gutiérrez [47], CHAT approaches emphasize learning as a process of social and cultural activity, rather than individual construction, in which "diversity is [viewed as] a resource and heterogeneity is a design principle" [47, p. 216]. These approaches gained particular currency in literacy education to address or account for apparent disparities without resorting to casting certain cultures as "deficit" [23, 47]. A prime application of the CHAT approach can be found in the Fifth Dimension after-school program [23], which spanned twenty years of research and involved multiple institutions, academics, and community stakeholders. A central goal of the Fifth Dimension was diversity in all respects – in the available activities, in the participants (at all levels, from student to institutional), and in the adaptability of the innovation to local context. Michael Cole, the leader of the project, noted that there are two prevailing views on diversity – "make it go away" (through assimilation) or "make use of it" as a resource for reciprocal exchange [22]. A decade after this statement, a review by UNESCO of sustainable development programs found that cultural differences remain all too frequently "interpreted as constraints to progress towards sustainable development... [i]ntercultural dialogue

is rarely seen as an opportunity to explore new creative ways to live or construct a sustainable future amongst diverse groups" [115].

For some, youth computing education [54, 94] might seem an obvious site for intercultural learning, but apart from occasional anecdotes noting intercultural interaction in developing contexts [2, 96, 106, 120, 131], there are few formal studies of its potential. Instead, there is an emphasis on diversity and inclusion that largely centers on access or participation to specific groups (efforts tending to occur in developed-world contexts, often framed by U.S. geopolitics; e.g., [97, 104]). For instance, a body of work explores designing culturally-relevant curricula [104] and activities to appeal to underserved minority communities [43] and to young girls [14]. Finding that the majority of work only involved gender, a systematic review by Kafai & Burke in 2015 of constructionist game development programs called for more studies involving ethnic identity [55]. Even in the broader topic of collocated digital technology initiatives for building intercultural understanding, few empirical studies exist: a systematic review of technology-for-peace initiatives in 2009 found only five empirical evaluations [125], and a 2016 follow-up found only a handful of virtual interventions [51]. Lamenting the lack of collocated interventions, the review concluded that it was essential for future scholars to not see technology itself as a solution but instead to identify "[technology's] affordances" for intercultural goals [125, p. 21].

Two separate efforts constitute rare exceptions: emerging translanguaging programs [126], which use computing education as a medium of linguistic and cultural exchange, usually between Spanish- and English-speaking students in the U.S.; and *Come_IN* computer clubs, a decade-strong program of the University of Siegen fostering integration of Turkish migrants [103, 110, 129]. *Come_IN* adopts the model of Computer Clubs, constructionist open-ended community spaces for marginalized youth housing computers [56]. In 2010, *Come_IN* launched in the West Bank with the intent of fostering intercultural interaction among refugee youth and student tutors living outside the camp [1–3, 128, 132]. Youth were free to choose activities, including film, 3D printing [111], or basic programming [3, 129, 132], or come to the centres for help with technology. Their focus, however, was mainly on the sustainability and implementation of the program, rather than the intercultural dynamics. Importantly, the authors remarked that clubs do seem to facilitate intercultural interaction between tutors and youth [132], and even peers across gender divides [2], but the mechanisms of *how* or *why* bonding occurred – and especially how *directed* computing activities might align or resist intercultural efforts – was not investigated at any depth. Interestingly, Yerousis *et al.* [132] attribute positive relationships formed to the caring efforts of volunteers rather than to the planned program or the technology.

The first step towards addressing these gaps is to involve a diverse population (already a key focus in computing education). Yet contact alone is often not enough for intercultural learning [9, 46, 99]; it can even reinforce prejudice [117]. This is possibly best evidenced by a line of studies on intergroup dynamics over computing activities, which usually focus on how difference affects cognitive and attitudinal outcomes in mixed-gender pairs. Results arising from such work can suggest pairing similar students together (*intra*group) to improve certain outcomes [21, 32, 59, 67, 130], or to provide intragroup settings to build solidarity [71, 72]. But even when participants are homogenized along one axis of identity, equity challenges remain. A 2018 report on a three-year girls' inclusive computing program found that the standard framing of classes did nothing to ameliorate the plight of some outgroup members, represented by the case of a young black girl who was ignored by her two white teammates [98]. Should diversity in computing education be about making intergroup challenges "go away" [22]? Should programs enforce intra-culture or intra-race pairings [59], as some studies recommend intra-gender pairs? Echoing concerns raised recently in CSCW [36] and beyond [62, 79, 101], the authors call for more work on how "intersectional identities impact... group dynamics" and remark on the partial nature of reporting on such initiatives: "...tensions are

all too common across after-school programs, yet are rarely shared in publications by those (such as ourselves) who feel responsible for such tensions" [98, p. 61-2].

How might we address these all-too-common dynamics? In education and international development, this question has spurred decades of research and frameworks for fostering intercultural learning, including peace education [99], intercultural education [24], multicultural education [10], and intergroup dialogue [46]. All of these approaches are grounded in intergroup contact theory [89] and, to varying extents, seek to provide shared settings that foster inclusive identity, tolerance, and critical dialogue. Examples of programs include: sports [61, 107], arts and theatre [133], writing [9], and non-digital games [82]. There is a widespread consensus that intercultural learning requires structured interaction [30, 89, 99, 107], with some emphasizing the need for students to reflect on their own backgrounds and biases to encourage "active empathy" [9, 46], as mechanisms of denial and defense are natural stages on the road to confronting internalized prejudice [11, 46]. Numerous case studies (e.g., [15, 34, 35, 86, 92]) provide strong support for the theory in developing contexts, with some additional caveats: a focus on an external task seems to reduce attention to differences, motivate participation, and improve interpersonal relations [99, 127]; cooperative tasks seem better at promoting bonding [26, 37]; and group composition, program design and scaffolding, and facilitator training improve efficacy [31].

Overall, the literature above reveals three things. First, while there has been work on inclusive access and digital technology as a lure for peace-building efforts, there is little work exploring how *directed* computing education actually performs as a site for intercultural learning, especially in post-conflict environments. Second, pedagogical design and instructional effectiveness are critical to intercultural learning; merely having groups interact, with or without the presence of computational tools, appears insufficient. Third, intercultural learning is difficult to address head on, especially when the participants are already embedded in deep cultural conflicts and tensions; often, a focus not so directly centered on group differences is required. These points motivate and inform both the program design and our investigation of the Nairobi Play Project.

3 METHODOLOGY

3.1 Author Backgrounds

Since this paper studies intercultural phenomena, the positionalities of all authors deserve particular mention [38, 101]. The first author and primary field researcher (hereafter referred to as the "fieldworker") is a white American male with experience designing educational technology for computer programming. He did not have a formal affiliation with NPP, though as part of ethnographic reciprocity, he made minor contributions to program implementation during fieldwork. The second author is an Eritrean-American woman and the founder and main designer of NPP. She has extensive experience designing and delivering creative computing programs around the world, including in Sierra Leone. The remaining three authors are faculty members at U.S. universities who collectively have several decades of experience in HCI-for-development research in South Asia and sub-Saharan Africa. Only the second author speaks one of the various non-English languages spoken by NPP students (Amharic) and has lived experience with any of the cultures represented in the communities of study. These positionalities posed practical and ethical challenges during the work, which we reflect on in Discussion.

3.2 Context and Study Population

Refugee communities in East Africa are a diverse mix of cultures cutting across nationalities, tribes, languages, and religions. Our study was conducted in the two geographies in which NPP operates: the more rural area of Kakuma refugee camp, and two urban communities of Nairobi. A total of 8

teachers and 232 students participated in NPP classes, split up into five sites (3 in Kakuma; 2 in Nairobi) and two cycles (120 students in Cycle 1; 112 in Cycle 2). All but two student participants were refugees. NPP recruited teachers through a partner NGO and paid stipends as allowed by the Kenyan government. While a few teachers dropped out due to repatriation, migration, or change in employment, all teachers appeared highly motivated by the intercultural component of the course and deemed it relevant to their lives.

In Kenya, many refugee children grow up and attend school entirely in refugee camps or communities [70, 74]. Pedagogy is often based on colonial-era educational models [44]: student-teacher ratios of 100:1 are common, and the goal is to pass standardized exams and obtain certificates to justify knowledge to employers [74]. Forms of creative problem-solving, indigenous knowledge, or intercultural understanding are typically neglected or discouraged. As one participant in our study summarized: *"In school, the teacher is writing here like this (points to blackboard), and we are trying to copy it [in our notebooks]. ... If you want to discuss, the teachers will not allow it."*

Three of the classes we observed took place in Kakuma refugee camp, established in 1991 by the Kenyan government to house migrants fleeing from conflicts in Sudan, Ethiopia, and Somalia [16]. Located in the arid desert near Kenya's northwest border with South Sudan and Uganda, today Kakuma[1] houses approximately 185,000 refugees and is one of two areas where refugees can live legally in Kenya [60]. Kakuma faces everyday conflicts from overcrowding, malnourishment, tribal differences, gender-based violence, and camp-host frictions [25, 50, 68].

The fieldworker stayed at a compound in the nearby town of Kakuma (15 minutes' drive away from Kakuma Camp 1), organized by the partner organization. They reached the town by driving across around 100km of dirt roads from the nearest airport. The United Nations forbids non-residents from entering the camps after dusk, as it is dangerous; for instance, residents told us they avoided using backlit devices at night because they worried the light would attract thieves. The sites were in isolated buildings behind fences, and youth were often seen playing football outside these areas at dusk. Quality food is scarce, consisting of UN-supplied rice and cabbage, chipati, small quantities of tomatoes and onions, pasta, eggs with discolored yolks, and often unidentified "meat," with fruit being rare and costly. Of note is the large presence of the Turkana, the pastoral host community, which is in frequent conflict with the refugee population.

Although refugees have no legal status outside camps, many live and work in Nairobi, the site of the two other classes we observed. Life is tenuous and hard, as job opportunities are often low-paid and scarce; police corruption, xenophobia, and discrimination towards refugees is also widespread and growing [16, 87]. The refugees we encountered avoided taking lunch, only having a light breakfast and evening dinner. To support themselves or their families, students would take menial jobs, with boys mentioning construction work. Most students were in school, but a few were not and suggested that the class served as a distraction from realities at home. Classes were conducted in slum areas in both East and West Nairobi. These areas were both located beside marketplaces and were contained – as is common in Kenya – inside gated compounds with security officers present. At low traffic, both sites were at least 45 minutes away from the centrally-located, upscale gated community where the fieldworker lived. For reference, a five-minute drive from one of these sites is an area where ethnic violence broke out in recent elections; near another is the neighborhood of Eastleigh (which our institutional review board prohibited us from entering, out of safety concerns).

Class times were coordinated to occur after school. In Nairobi, teachers recruited students by posting sign-up sheets and posters in these areas, targeting a 1:1 gender ratio. Gender representation was balanced except for one class in Cycle 2 which was majority male. Students came from areas around each site and transit costs were chief barriers to bringing in populations outside the local

[1]We refer to the refugee camp area as "Kakuma" throughout, but the camp area is distinct from the town of Kakuma.

area. In Kakuma, teachers participated through refugee community-based organizations (CBOs). To recruit students, teachers spread the word by visiting nearby schools, coordinating with principals and school teachers, and putting up posters. NPP targeted a female-to-male student ratio of 3:2 in Kakuma and came close to reaching this target. Student nationality included Democratic Republic of Congo (DRC), Somalia, North and South Sudan (henceforth, S. and N. Sudan), Burundi, Rwanda, Tanzania, and Ethiopia, across varied tribal identities. Across all sites, literacy levels varied widely and most participants spoke at least two of three languages, to varying degrees of aptitude: English, Swahili, and a tribal language.

Finally, there is a important detail key to parsing our findings: "Great Lakes" cultures is a colloquialism referring to nations situated around the Rift Valley: Burundi, Uganda, DRC, Kenya, Rwanda, Malawi, and Tanzania. Many participants of these backgrounds practice Christianity. Students of Great Lakes cultures usually grow up familiar with Swahili, while migrants from S. or N. Sudan typically learn Swahili when they arrive, speaking indigenous languages, dialects of Arabic, and English (which is the official language of S. Sudan). Cultural differences in communication styles, both linguistic and non-verbal, sometimes made it difficult for those from Great Lakes cultures to communicate with Sudanese and Somali students.

3.3 The Nairobi Play Project

The Nairobi Play Project was designed as a progressive pan-African education model, theoretically grounded in critical pedagogy, constructionism [53], and intergroup contact theory. The goal of the model is to cultivate intercultural learning between communities in or at risk of conflict. This iteration of the program was funded by The United Nations Children's Fund (UNICEF) Kenya Country Program, and implemented by Kenya-based non-profit organization Xavier Project in coordination with the Nairobi Play Project team and local community-based organizations.

The program was designed as 30 after-school sessions which run 5 days a week for 6 weeks, targeting 24 students and 2 informal educators per class. Each session is 2 hours long and generally starts with a warm-up activity or icebreaker, followed by a creative computing or game design session. The activities involve intercultural exercises, computational thinking and game design, and the curriculum strives to integrate these to cultivate problem-solving, self-expression and iterative practice. Programming activities occur in Scratch, the widely used graphical programming platform [94]. Many activities are localized (e.g., redesigning the East African game *Mancala*). The program occurs in three sequential phases:

(1) Phase I of the program centers on building trust and friendship between students, introducing students to game design and storytelling, and learning basic computing concepts through remixing, debugging and making projects. This phase also involves a dozen warm-up activities, designed to enhance intercultural dialogue and teach computational thinking. Throughout Phase I, students are also asked to program in pairs; teachers were instructed to pair across nationality and tribe (although many paired cross-gender and made ad-hoc pairing decisions).
(2) In Phase II of the program, students decide on a community-based theme for a game they will build. After an introduction to real-world figures about the Sustainable Development Goals [80], participants work in their teams to investigate and negotiate the who, what, where, when, and why of their game through discussion, peer interviews, and personal stories.
(3) In Phase III of the program, students create a fictional narrative using what they decided in Phase II to construct their game. Team members take on different responsibilities (coder, artist, writer), switch roles when prompted, and check in with each other until the project is complete. The program closes with a celebratory playtest.

While the core curriculum remains the same across classes, each teacher was instructed to interpret and adapt the curriculum according to their own understanding and in response to emerging local conditions and constraints. The five classes reported here were spread across two cycles (February-April and June-July, 2018) with a round of teacher professional development having occurred between the cycles.

3.4 Research Methods

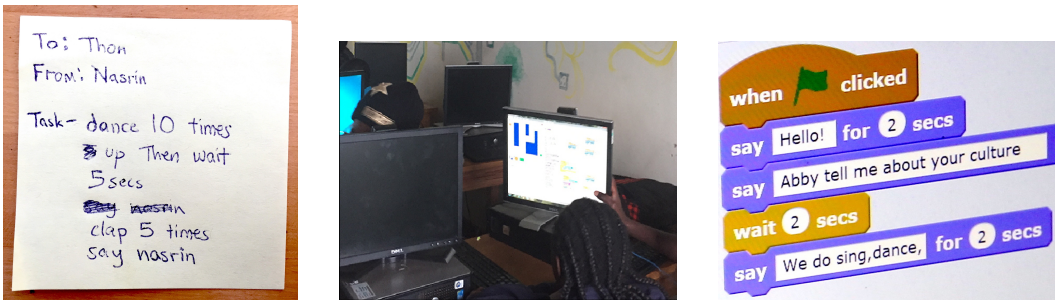
Our investigation was qualitative, with data from a variety of sources: fieldnotes, semi-structured interviews with teachers and students, teacher self-reporting on a shared WhatsApp group, and pre- and post- surveys. For teachers, we asked for written consent, and interviews were audio-recorded. With the exception of Cycle 1 students and one Cycle 2 student, all student interviews were conducted on-site during class. We sought oral assent and hand-wrote all responses. Student interviews were in most cases conducted with a Swahili translator present, and some students switched between English and Swahili in their responses. Participation in the research component was voluntary, having no effect on students' ability to participate in activities. We offered small refreshment (tea, lunch, drinks, snacks) to participants when possible.

We gathered field-notes from the first eight days of Cycle 1 in Nairobi and professional development sessions in Nairobi and Kakuma. To preserve anonymity, we often refer to broad characteristics and use abbreviations: sites in Nairobi are N1, N2; sites in Kakuma are K1, K2, and K3. Students are labelled S1, S2, and so on, and teachers are labelled T1, T2, etc. Thematic analysis of coded fieldnotes during the first cycle provided grounding [19] for composing questions and observations for the second cycle. During Cycle 2 we gathered fieldnotes across all 5 classes, conducted semi-structured interviews with 8 teachers and 24 students (13F/13M; 13-19 years old), and held 4 informal follow-up interviews and phone calls with teachers. In addition, a teacher held brief informal interviews with 2 students. During Cycle 2, with the exception of N1, classes were composed of 24 students selected semi-randomly from recruitment lists of at least 48 students at each site. The randomization procedure stratified by nationality and gender to ensure diversity and reach gender targets. In addition to 302 pages of fieldnotes (164 handwritten, 138 typed in Arial 12pt. with standard margins), we took photos of documentary material and sketches of seating arrangements. Fieldnotes for Cycles 1 and 2 complemented one another by switching primarily from verbal to behavioral observations. In addition, teachers administered pre- and post- surveys. Although significant challenges hampered collection of all surveys, we include open-ended responses from 43 student's post-program surveys from four sites (24 K1; 9 K2; 9 N1; 1 N2) in our qualitative analysis. All data was analyzed through iterative thematic analysis, with a focus on intersections of intercultural learning with computing and pedagogy.

Throughout, we strive to be exact about the nature of differences relevant to an observation. "National" is used where differences seem most likely due to differences in nation of origin; similarly for "tribal." "Cultural" is reserved for cases where the difference is difficult to attribute, or where broader background differences appeared to be in play.

4 FINDINGS

Our findings are broadly categorized into cases where (1) computing activities appeared to support intercultural learning, (2) obstacles emerged to such learning that had to be managed or overcome, and (3) moral dilemmas complicated normative accounts of intercultural outcomes. Note that while teaching computational thinking and programming skills were key goals of the program (and are evaluated separately in other work), our focus here is squarely on intercultural learning.



(a) (b) (c)

Fig. 1. Interactions over computing activities: (a) During a warm-up, a Somali girl instructs a Dinka boy to perform a procedure (reproduced, with names altered); (b) One cross-cultural pair shares code to another pair by rotating their monitor; (c) Coding part of a conversation about culture between characters.

4.1 Computing Education in Support of Intercultural Learning

A consistent finding across our sites was that computers provided a powerful incentive to gather across divides. Students often cited computers as the sole reason they took the course, voicing a vague belief that computers will help them in "the future" though many could not elaborate exactly why. Some took pride in being the first in their family to use a computer, e.g., *"Our father, our grandfather, our tribes – they have never touched a computer."* Others emphasized a desire for credentials as printed certificates. Both aspects seemed to justify the participation of students to parents. T8 appealed to aspirations: *"You have to [tell parents] the advantage of [the computer]... 'The future we are going in, it is all about technology.'"* In particular, the presence of computers could mitigate mother's concerns about their daughter's continued participation. Somali girl S24 said *"My mother is okay with [the class] because I am the first person in the family using a computer."*

Once students were in the door, the question became how to engage them in the program's intercultural goals while satisfying their appetite for computing activities. By design, NPP blurred the distinction between the two goals: activities sometimes had simultaneous intercultural and computational learning objectives. Both high tech games and low tech activities could put students in the shoes of another. For instance, "Empathy Notes" – labelled an intercultural activity – asked students to write instructions to a fellow student which that student then has to perform; these looked like pseudo-code (Fig. 1a). Unspecified aspects of pseudo-code could surface culture; for example, a Somali girl was instructed to sing, and proceeded to cover her face with her chador and sing softly in Somali. Later discussion addressed how students felt writing these notes. Many participants attributed later cross-cultural bonding to similar low-tech warm-ups and their role in sanctioning intercultural interaction.

Mechanisms of bonding often seemed to revolve around *shared humour* arising from frictions between participant expectations and outcomes. While such moments could be intentional (S13: *"sometimes, we create games that are funny"*), even in cases of communication difficulty, unintentional humour seemed to play a more prominent role. Multiple teachers and students attributed the cause of laughter to "mistakes" or incongruities (e.g., a mouse chasing a cat), backing up fieldnote observations (T5: *"Once they find a mistake or [do] something amusing, they laugh, and sometimes they clap their hands."*). Breaking the silence between them, a Congolese boy and a S. Sudanese boy started giggling as their cartoon cat became stuck in a maze wall: *"We want to move it down but it moves up,"* said one. Breakdowns over low tech activities had similar effects; for instance, in one

activity two teams gave each other "code" to act out, resulting in laughter when students made a mistake. The same activity seemed to prompt students to open up and speak with one another.

Other moments of bonding appeared to be driven by limitations in resources and infrastructure. Individualized devices such as the mouse, keyboard, and earbuds presented bottlenecks that produced frictions between pairs negotiating for use. Students had to vie for control of a device, providing opportunities for assertion and restraint, and for teachers to encourage active communication. When asked how he made cross-cultural friends, S17 replied:

> *Our teacher told us you must sit together – for example you're Congolese, you're Sudanese. They mix us... We have to communicate. Because there is only one computer. You cannot make something without the computer.*

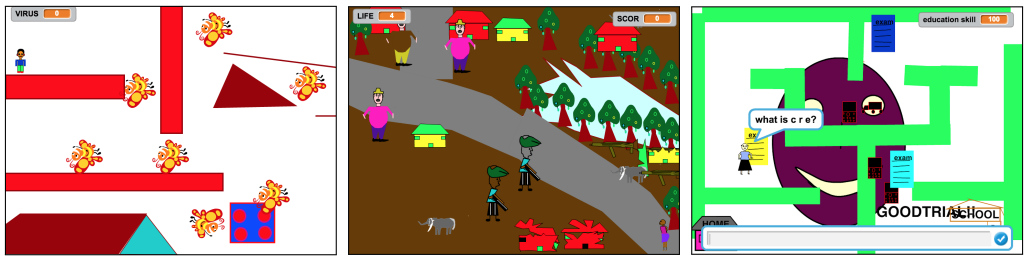
Communication could occur through nonverbal means, including in cases of communication difficulty, but even when language was not an issue. For instance, S6, a Congolese boy, said he was having difficulty conversing with S27, a S. Sudanese boy, even though they were both fluent in English. *"If there was a mistake [my partner] doesn't speak, but he shows (gestures as if pointing to the screen) – shows the mistake. And he took the mouse [from me] and corrects the mistake."* Indicative of intercultural competence [27], S6 asked S27 to modify his behavior: *"His voice is low, is low!... If you say to him to speak loudly, he will at that time. But not normally."*

Instances of pair bonding over a shared task could bridge what appeared to be even large divides. Several teachers began to see Somali girls in particular *"sitting with boys from different tribes."* T4 regarded this as *"very rare"* in Kakuma camp or even *"impossible,"* as Somali girls traditionally only engage in limited forms of communication with boys. In one case, a friendship developed between Somali girl S26 and S. Sudanese (Dinka) boy S25, who went to a boys-only school. Early in the program, the girl communicated mainly with her Somali friend. Yet in a later interview, the boy said he was making friends with both girls, citing his partner's abilities: *"I feel good because the girl is very social... She really understands. I like the way [she] concentrates... It really helped me."* The girl initially hesitated to reciprocate. When given a chance to choose a partner from the class, she didn't choose her partner *"because he doesn't understand that he's a boy."* Yet two weeks after the program ended, she wrote, *"yes, I have a new friend [S25] who was my computermate and become my best friend."*

Yet sites of bonding, particularly where prompted by breakdowns in understanding, were not just limited to deliberate pairings. We observed many instances of brief, one-shot interactions across pairs or in unstructured moments. For instance, a Burundian boy and a Ugandan girl demonstrated their code for another pair –a Burundian girl and a Somali girl. This kind of helping often entailed rotating the screen or laptop so that others could see, as in (Fig. 1b). In other cases, students bonded during gaps in instruction; for example, while teachers prepared, a Kenyan boy explained the concept of a 'forever' loop to a Rwandan girl absent from the previous class.

Finally, many moments of friction occurred over group projects, where students had to contribute and codify their ideas. Such moments included: ideation and brainstorming; constructing scenes relating to culture inside Scratch (Fig. 1c); playful argumentation with hands during prototyping; and cultural conflicts over design choices. For the last, a team of four (Burundian (M), Somali (M), Dinka (2 F)) decided on "malaria" as their final game topic, and had a disagreement whereby Dinka members argued that reaching an indigenous plant medicine should be the goal. Somali boy S22 disagreed, saying that was *"old fashioned, you should embrace the new one, you shouldn't believe that anymore,"* and argued for red malaria pills as the goal. The team went with S22's design (Fig. 2a).[2] Final game topics included peer pressure to smoke bhang (marijuana); the government

[2] Although this reflects how cultural difference can surface from directed pedagogy, it also represents a potential complication to intercultural efforts that we will explore in a following section.



(a) (b) (c)

Fig. 2. Group game designs embody experiences shared across difference: (a) a boy avoids mosquitoes to reach red malaria pills; (b) a woman flees across a border as "terrorists" block her path; (c) a student vies to finish their education by answering questions on exams and dodging distracting mobile phones.

blocking UNHCR's attempts to expose corruption; cleaning up Uhuru park; avoiding *"bad boys"* on the street; planting trees; the importance of listening; and the problem of open defecation. Many themes reflect shared experiences – such as migration to Kenya or school education (Fig. 2) – and thus indicate design being used as an opportunity for building common ground. Others, e.g. a game about child brides, reflect possibly more personal or traumatic experiences of their group leaders.

4.2 Overcoming Obstacles to Intercultural Learning

As already intimated above, the intercultural objectives of NPP also faced numerous practical obstacles. Some of these emerged from gaps in program structure and design that were filled in by caring initiatives taken by teachers and students [58]. In these cases, built-in diversity could be used "as a resource" to contribute to intercultural goals, *provided they were consciously attended to.*

As noted above, aspirations around computing served as a key motivation for gathering and participation. Once students arrived and learned who was in the room, however, there was no guarantee they would stay. One of the most prevalent cases of friction occurred between Dinka and Nuer participants, communities in active conflict.[3] A Nuer teacher encountered two Dinka students in his class who stopped coming upon learning his tribe. In response and on his own initiative he traveled to a Dinka section of Kakuma to encourage the boys to remain in the program. *"Even my people say, 'Why are you going there? They'll kill you...' No, they won't kill me. I'll talk to them."* The boys returned after his visit and finished the program, indicating to him that their negative perceptions had shifted, albeit tentatively.

Even if students were in class and eager to listen, they often resisted intercultural interaction. Across sites, students' natural tendencies were to sit with others like them. This resulted in groupings by nationality, tribe, or school early in classes. For instance, we saw Somali girls clustered into one corner; students clumped by the same school uniforms; and the only three Congolese students in one class huddled around one laptop. These tendencies to sit together (or apart) could crystallize through force of habit, limiting space to maneuver, and the reinforcing materiality of devices. At some sites students labeled their laptop boxes with their names or grew attached to project files saved on laptops; at classes with more computers, some students were seen working alone to take advantage of additional resources. Devices could distract students (T4: *"They were eager to use computers... I tried to explain them 'no, this [intercultural activity] will assist you in your lives.'"*), which could suppress encounters especially during gaps in instruction. At all sites where the

[3] A 2018 report funded by the U.S. Institute of Peace estimated approximately 382,000 casualties in South Sudan between 2013-18, resulting in an influx of 2.5 million new refugees in neighboring regions [20].

internet was present, students visited YouTube (in some cases, wearing headphones and shutting others out) or played video games – media which could include violence. By contrast, in sites without internet, students were seen collaborating and focused on programming projects, especially before classes began.

Yet these situations presented opportunities for teachers to make intercultural goals explicit. By breaking up order and ritual, the *act* of disruption itself seemed to help students to reflect on their mindsets. S13 said, *"You cannot stay in the same place without interacting with each other. The teacher would tell us to communicate with each other, to get to know each other better."* Moreover, the reinforcing materiality of devices also provided powerful opportunities to have the opposite effect, to act as glue to sustain otherwise contentious (or nascent) pairings. Indications were that the intercultural friendship mentioned earlier between S. Sudanese boy S25 and Somali girl S26 only occurred because these students sat together over a sustained period, tied materially by their labelled devices after paired by the teacher. In other cases, students who were paired on previous days could return to those locations by their own initiative, suggesting that the "sticky" and affective properties of devices might be employed to sustain new arrangements.

Language differences could also hamper communication. Although NPP did not enforce a language of instruction, lesson plans were written in English and teachers chose to teach in English (even at sites where Swahili was common), switching into Swahili only occasionally. T3 summarized their position along three points: English is the *"language of computers"* (OS and Scratch software were both in English), Swahili does not have well-known terms for many computer peripherals or topics, and many students believed that if they learn English, they will be more successful in life. This gatekeeping proved difficult for Swahili speakers less versed in English, to the extent of causing dropout in two captured cases. Yet these frictions and oversights could also be fuel for interaction. Students used these challenges as opportunities to help others through translation, with some noting they were making cross-cultural friends through such transactions. For Sudanese students, English knowledge seemed especially advantageous. While working together on the final game project, S. Sudanese boy S10 and Congolese boy S11 both cited S10's knowledge of English as a source of bonding: *"When English words become difficult for me, [S10] will come and help,"* said S11.

Still some opportunities for dialogue may be inhibited from perceptions of appropriate cultural behavior. Teachers used this resistance as a chance to encourage these students. T5 recounted a Somali girl who returned to the centre after the program ended to continue programming practice:

> *First of all, she's very shy. She doesn't understand, she doesn't ask questions... I asked her, "Is that how you behave at home? Do you speak with your father and brothers?" She says, "No, I'm used to talking to them." I said, "Here, we are united by this class regardless of our culture and religion." Then from there... I made her the group leader so that she'll stand up and read what they discussed. From there, she gained confidence... In her religion, she says that a woman can't stand in front of people. I say, "No, how come? I've seen Somali girls who speak and stand..." So, in the end, she has changed.*

It is important to note that the ability to turn challenges into resources for intercultural goals hinged upon the built-in diversity of classes. At N2, logistical challenges prevented NPP from selecting students, resulting in a student composition mostly from the same tribe. The class resulted in a reversal of intercultural goals: one boy of a darker skin tone and different nationality than the majority appeared to be making new friends in N2, even while not making friends at school, yet his post-survey responses suggest *negative* effects on his attitudes towards cultural others. It turns out that he had experienced instances of exclusion: His teacher overheard his teammates insisting on using their language saying, *"hey, when you speak your [tribal] language, do we understand?"* The teacher thought that the majority of students at N2 were not internalizing the cultural activities:

"It's like, they're not willing to go past their culture." This case highlights a potential crux, that class make-up must be diverse enough that no single group stands out as a minority.

4.3 Complications of Intercultural Learning

The previous sections involve instances of intercultural learning, particularly at sites of frictions, breakdowns, and gaps. However, whether instances of intercultural engagement are truly positive is not always clear. We now turn to more complicated examples of intercultural outcomes, representing value judgements on meaning making and behavior change. These examples illustrate how frictions and gaps, before framed as opportunities for learning, could also shift into ambiguous or negative outcomes even when participants are following structure or bonding across difference.

First, while the need to communicate over shared devices had the potential to bridge divides, it could also be a site for conflict and inequity (as others have cautioned [66, 88, 95]). In one case, when his partner took complete control of the computer, a boy left the pairing to work with a girl from his own tribe, remaining with her for the remainder of class. At the same time, students were aware of such dynamics. S21, a Ugandan girl, liked to work with the Burundian boy she was partnered with saying that *"[he] is ready to listen... everything is equal,"* but *"when I observe other pairs, one person is taking control of the computer."*

More problematically, even *if* all learning outcomes are ostensibly being met, with students designing self-expressive games and bonding with those from other cultures – *what* students are bonding over could be controversial. For example, intercultural bonding can occur over shared xenophobia. In one case, a team designed a game whereby migrants reclaim lands by killing all male members of another tribe. The team was composed of three boys – two Congolese (from different tribes) and one S. Sudanese. One of the students, who came from a tribe recently displaced due to violent conflict, explained that he wanted to educate refugees on how *"to emerge from struggle and suffering."* He said his teammates could identify with the game's story. We pressed him several times as to whether there was another solution or design, but he finally explained, *"If you don't kill the thieves, they will come back. If you kill them, the story is finished because they are dead."*

Third, there were instances of intercultural learning which appeared to bring pressures to assimilate to the dominant culture. Before, we showed how gaps in the program provided space for dialogue; but they could also present opportunities and/or pressures for students to practice new behaviors typically prohibited by their culture. One prominent instance involved Muslim (Somali or N. Sudanese) participants. These students wore hijabs or chadors and came from families that prohibited physical contact – including handshakes in greeting – with males outside their family. Teachers told us that this practice initially created negative perceptions among participants from Great Lakes cultures. At multiple sites, participants negotiated this practice during a warm-up activity that involved designing a new handshake. Though not forced to shake hands by the teachers, some Somali girls began shaking hands from beneath their chadors; others eventually with their bare hands. These students were seen shaking hands during unstructured moments days or weeks later, such as after peer game demos or before class.

5 DISCUSSION

Overall, we saw evidence that computing education provides unique opportunities to support intercultural learning. We also found that many moments of intercultural learning were contingent on sites of friction, breakdowns, and gaps, whether planned for or around, or as unanticipated conflicts among the program, participants, and technology. Finally, we encountered a number of instances that complicate any straightforward relationship between computing and intercultural learning. For all three of these findings, we found that teacher capacity was the most important factor in the degree to which intercultural learning takes place. Teacher capacity was often decisive

in how well they attended to the program's intercultural goals, managed conflicts or obstacles, and led project-based computing activities. This is consistent with prior literature in technology and education [40, 116]. With this in mind, we first connect to related literature in cultural-historical activity theory (CHAT) to provide additional insights, before discussing our key findings and potential implications.

Our findings align with a CHAT perspective on diversity [23, 47] in exploring how NPP's curriculum and structure, coupled with the local realities of implementation "[provided] resistance and affordances to [its] attempts to reach" its intercultural objectives [57, p. 66]. For instance, the computing activity system provided certain *affordances* for intercultural learning and encounter, such as promoting shared laughter through breakdowns, and frictions between pairs negotiating for use of devices. We also found that *resistance* to the innovation's intercultural goals could present critical opportunities for learning in their resolution. Following Engeström, situations involving resistance may be viewed as "contradictions" embodying "the clash between individual actions and the total activity system" [39, p. 98]. In reference to Cole's work on the Fifth Dimension, Gutiérrez *et al.* emphasize how these "contradictions, experienced by us as conflicts" can be "a major source of change" [47, p. 217] and how diversity may be used "as a resource" to address program goals, provided participants are primed to see it as a resource. Said more explicitly, a CHAT perspective recognizes how the many frictions, breakdowns, and gaps present in classes – experienced often as "conflicts" – may instead be mined as resources for intercultural learning, rather than detriments to fully "solve" or overcome. In addition to this straightforward way of looking at NPP, we found ambiguous situations which appeared to be affording and resisting intercultural objectives simultaneously, but in different ways. For instance, the actions of participants to bond cross-culturally over shared ideologies or practice new cultural behavior is, locally, certainly intercultural learning, yet viewed from a broader vantage point may constitute negative outcomes involving reinforcing xenophobia and cultural assimilation. We prefer to use the term *complications* to invoke the subjectivity involved in casting these particular situations as contradictions. We use these terms in our Discussion going forward.

5.1 Affordances of Computing Education For Intercultural Learning

Our main finding confirms that directed computing education can be a site for productive intercultural learning and provide unique affordances for such efforts. As others have found of computing centres in India and Thailand [18, 78, 120, 131], computing attracts diverse groups of people, even – or perhaps especially – in places of conflict and limited resources. Echoing findings by Pal *et al.* in rural Indian contexts [84], our participants and their parents indicated a willingness to engage with NPP exactly because of computing's promise of future opportunity, and despite potential misgivings about other aspects of the program. Computing education thus has potential to lay the foundation for applied intergroup contact theory for our context [46, 99], as the desire for computing education can cause and sustain interaction across cultures.

Next, the physical aspects of computing – its hardware and software – afford the possibility of shared use among diverse parties. While device bottlenecks are often framed as a potential downside for content learning in ICTD (e.g., for the computer mouse [49, 85, 88]) and much literature on cross-cultural computing in CSCW and beyond stresses interactions over the internet [125], in our context device bottlenecks provided numerous occasions for interaction in the same physical space. These observations intersect with the growing body of work concerning youth pair programming and cross-gender interaction [21, 29, 55, 59, 65–67, 130]; here, we found that in addition to cross-gender interaction, paired programming can also be effective across cultural divides, and even in cases of communication barriers, provided additional structure (although interactions were not

always positive, as Lewis remarks [66]). Similar to work in computer clubhouses [132], gaps in formal structure could also present opportunities for dialogue and sharing.

Especially worth calling out are the opportunities that computing education affords for humour. Prior work has framed laughter over educational electronics activities as "playfulness" [98], but has not shed light on why it occurs or whether it may contribute to cross-cultural bonding. Here, we found that many instances of laughter among students appeared to arise from breakdowns and semantic incongruities, aligning with theories of humour in psychology [73]. Such non-aggressive laughter is a universal signal of happiness and joy [100], and when it is shared among cross-cultural groups – even those in tension – it is an encouraging sign of eroding barriers and developing friendships [91]. There is literature about collaboration in the workplace that shows humour to improve social bonding and create rapport [75, 77], and in HCI, Morkes *et al.* [77] found that in task-oriented pairs communicating via computer, humour improved relationships. For laughter over high-tech activities, we speculate that Scratch's cartoon-based graphical programming environment underlies some of our findings here, as it allows for language- and culture-transcending opportunities for humour. Other graphical programming environments may provide similar opportunities.

Finally, a question remains of why to choose computing education over other (possibly less expensive) sites for intercultural learning. While we are not aware of any intercultural programs integrated into math or science education (beyond multicultural approaches to course content), we speculate that such sites would face challenges of participation and language barriers, and the important narrative, humour, and group activity elements are liable to be missing or more difficult to achieve. One potential comparator is sports, commonly used for intercultural learning in under-resourced contexts [107], especially Kenya [61]. There are some overlaps between the two: both sports and computing education encourage communication, teamwork, physical and visual engagement, and potential for humor. And there are some unique advantages to sports, such as the possibility of bonding with minimal language difficulties. But computing education also has distinct benefits. First, as studies in India also suggest [84, 114], computing might appeal more to parents for its economic potential, even across gender divides and as children age (problems for sports programs in Kenya [61]). Second, computing education can be readily adapted to emphasize the sharing of personal and community narratives, an approach which critics of sports-based programs such as Spaaij & Jeanes have argued for [107]. Third, computing education can be purely collaborative, rather than competitive, and studies suggest that collaborative activities are better at promoting bonding [26, 37]. Finally and most significantly, while sports might require something "extra" to address intercultural learning, many of the activities we observed in NPP suggest that computing and intercultural learning objectives can be combined in the same activity. For instance, we found that computational thinking's *perspective-taking* method of "body-syntonic reasoning" [54], which encourages programmers to take the point of view of graphical agents, gels easily with perspective-taking activities to build empathy [9].

5.2 Breakdowns and Resistances Can Spur Intercultural Learning

Perhaps the least expected of our results was the degree to which unplanned, unspecified, or under-resourced aspects of the program could present opportunities for intercultural learning. The most salient aspect of resistance to intercultural encounter was a tendency for students to sit with same-sex, same-culture peers. Teachers would deliberately disrupt these arrangements; affected students were often the ones who later on made conscious mention of their intercultural learning. This finding connects to guidelines of intergroup contact and empathy programs involving the use of active reflection [9, 46]. Another important aspect of resistance was how the ready availability of resources – such as internet connections, or the mere presence of more computers than needed for pairing students – could inhibit intercultural goals, as students were less likely

to engage in cooperative work with their classmates. These findings align with activity theoretic studies explaining, for instance, how the presence of internet connections in classes tends to cause distraction rather than content learning [57]. We emphasize that, while computers can indeed support cooperative work, they have to be applied judiciously.

Not all outcomes from resistance were specific to computing or computing education. Some of the most profound forms of intercultural engagement could occur though initiatives taken by teachers and students to repair unplanned tensions or breakdowns. Karusala *et al.* explored these initiatives as a resource of "care" in underserved learning environments [58]. For students repairing language barriers through translation, studies of translanguaging in educational contexts have found similar outcomes and explored them in much greater detail [23, 126]. However, we found that for resistance to contribute to intercultural learning, diversity must be present (and apparent) in computing classes to begin with. A homogenous class can re-enact the very discrimination NPP's intercultural activities sought to address; studies show minorities can experience heightened discrimination in mainly-majority educational contexts [118]. This is further evidence that educational computing activities may not by themselves result in equity outcomes, as Vakil cautions [122]. As in Ryoo & Kekelis's study of an inclusive girls' computing program [98], even one of NPP's best teachers was unable to overcome the majority's resistance to intercultural goals, despite attempts and high motivation to do so.

5.3 Complications to Intercultural Learning Seem Unavoidable

As above, for the most part, we found NPP's combination of computing education and careful pedagogy to be effective at enabling intercultural learning, even though not all of the outcomes were explicitly planned. But, like in intergroup dialogue [31], we also witnessed several cases where the intercultural outcomes were questionable or outright problematic. One of our most surprising findings was how, somewhat counter-intuitively, intercultural bonding can occur over the creation of artefacts with xenophobic themes. One student's comment that his goal was to teach refugees resilience through violent battle strikes at the core of this complexity. Prior work in the field (e.g., by Kafai & Burke [55]) imagines constructionist game design as an opportunity for learning, always as a positive outcome. Our work adds a caveat: that critical game design, even with prods to express ideas constructively, does not mean that every game will conform to universally positive values. Indeed, some games – if eventually distributed to a larger community – might increase hostility.

In other cases, it was not clear that the achieved goal was universally positive. For instance, Muslim girls shaking hands despite parental prohibitions, or a Somali boy telling Dinka teammates they should embrace the dominant culture – these outcomes deserve to be questioned on a moral basis. Learning a foreign gesture for greeting is undoubtedly intercultural learning, but some cultures may see specific forms of greeting as a transgression against modesty. Should we as outsiders to these communities encourage such learning? In a critique of intercultural education, Gorski points out how some initiatives fail to account for power relations, calling for pedagogy which addresses how "culture and identity differences... affect one's access to power" [45, p. 522]. While there is a tension between this critique and NPP teachers' agency in making decisions, what we witnessed of teachers negotiating these complications only begged the question. Some teachers betrayed beliefs that certain cultures had aspects "better" than others. Importantly for intersectional concerns [62], none of our participant teachers were Muslim, most were male, and most were from Great Lakes cultures. Future work might explore how a Sudanese or Somali Muslim woman might have negotiated such dynamics or viewed NPP's activities, or how teachers' own developing

intercultural competence, and possible ethnocentric tendencies,[4] manifest in similar moments of friction. While it would seem that *some* forms of intercultural progress require transgressions against individual cultural norms [112], and complications seem unavoidable in the large [31], the fact that teachers did not intervene – or even view as potentially problematic – some of the complications we outline here points to the need to further build teacher capacity in intercultural competence.

5.4 Implications for Program Design, Diversity and Inclusion Efforts in CSCW, ICTD, and Allied Fields of Work

Recently, some CSCW researchers have challenged the constructivist rhetoric around youth computing education [5], suggesting that an "atomistic" notion of hackers fails to encourage true collaboration or cooperation, especially across cultural lines. Meanwhile, other studies suggest that computing education spaces may be particularly conducive to helping students develop collaboration skills, e.g. inter-gender [2, 131], inter-cultural [132], or inter-generational [18] learning. Our observations complicate this narrative. On the one hand, we find technological affordances that might encourage intercultural collaboration, but more significant is the role of teachers, structure, and pedagogy. Consistent with criticism of other educational technology [116], creative computing technology by itself does not appear to be the main cause of intercultural learning. In fact, aside from exceptional moments, even highly creative and well-designed computing spaces may not be reasonably expected to lead to such outcomes without additional structure and targeted support for intercultural goals. Prior work in computing spaces for intergroup goals [2, 131, 132] reveals that physical spaces provide a context where these goals are held by facilitators and/or baked into the educational program (e.g., a political agenda to resolve gender disparity [131], or tutors managing youths' resistance to mixed-gender pairings [2]). These readings align with U.S.-based studies that caution that computer-supported educational programs can find gender or racial inequities reinforced over activities – whether in person [59, 79, 98] or through the internet [6] – supporting theories that, without human intervention and support, technology tends to reproduce or amplify existing inequity [41, 90]. Our findings thus align with peace education, empathy-building, and intergroup contact literatures [9, 46, 125] which suggest that those looking to foster inclusive spaces should provide structure that makes participants *conscious* of program goals, rather than simply expecting technological activities to cause intercultural learning, especially with regards to prejudice or equity. Emerging work in critical computing education operates under a similar premise [79, 121, 122].

We conjecture that our findings have relevance for a wide array of sites and efforts, from informal learning initiatives like community makerspaces to more formal settings like New York City classrooms struggling with sociocultural tension. As touched on in Related Work, cultural tensions are also active in U.S.-based computing education settings, both formal and informal [79, 98], and cultural tension is of course a topic numerous equity scholars outside of computing have explored.[5] Our primary lesson is the need to embrace (and not just avoid) moments of friction, breakdown, and gaps, and recognize and make use of these as opportunities for intercultural learning, following CHAT approaches. Both program implementers and teachers should include this lesson into their practice: at the very least, teachers need to be prepared to improvise in good faith in response to emergent and culturally challenging situations, such that students may follow

[4] NPP's program designers considered this potential for teacher bias and included activities addressing it during teacher professional development; however, limited funds and time caused them to focus primarily on teaching creative computing and pedagogy, rather than intercultural competence.

[5] See, for example, Prudence Carter's comparative study of U.S. and South African schools which makes the case for "cultural flexibility"' and intercultural learning as key moments in the resolution of wider educational and social disparities [17].

their example. Here, NPP's professional development included sessions on intercultural competence and confidence building, and paired teachers to complement technical with intercultural aptitude. Second, program implementers should ensure rich diversity as much as possible in class composition, as a little diversity (where some minority groups feel truly marginalized) may be counterproductive. Following these two suggestions, students should be made conscious of intercultural goals – not necessarily bombarded with rhetoric at the outset, but in teaching moments where intercultural conflict or neglect may arise.

The remaining points are specific to computing education. First, alignments should be sought between computing activities and intercultural instruction; for instance, the perspective-taking affordance of computational thinking can be leveraged to present localized examples of sociocultural tension, and shoulder-to-shoulder programming can be an excuse for intercultural interaction. Second, implementers should consider how the placement and availability of computing devices affords opportunities for interaction. For instance, how many laptops should be distributed given the number of students? Where should they be positioned? How can the location and use of limited resources, e.g. charging stations, support moments of student and intergroup encounter? Even while offering education about computing, limiting access to the internet can ensure that attention stays within the room. These points are meant to be suggestive, rather than comprehensive; we intend to provide treatment of teacher training, program design and scaffolding in future work.

5.5 Limitations and Positionality

There are a number of limitations to this study, the most significant of which is the outside status of authors with respect to the refugee communities of study. To the extent possible, the fieldworker tried to minimize misinterpretations by relying on formal teacher and student interviews and informal follow-up questions to clarify or expand on events, especially when conflicts were involved. All findings were also discussed by the co-authors in depth, assessing credibility against our collective experiences in East Africa. Yet it is nevertheless likely that a white American fieldworker would have periodically missed or misinterpreted subtle gestures and speech expressed by participants, or indeed that participants may have altered their behavior in the fieldworker's presence. Two particular challenges were the many languages that were regularly heard in the classroom, and the ability to see cultural (as opposed to individual) differences in communication styles. To an extent, similar challenges of communication were faced by participants themselves, as aside from N2, there were no instances of a single tribe, nationality, or language being a majority.

A second limitation derives from our choices and restrictions. To study intercultural learning, we "sampled" (participated, interviewed and observed) across 5 class sites, rather than following a single class setting end-to-end. This had the benefit of allowing us to see more general and comparative patterns, but had the drawback of potentially missing some emergent patterns and also more transient negotiations and arguments, especially during final projects, leading us to focus primarily on data involving Phase I of NPP. Compounding this challenge of data collection, NPP was asked by partner staff not to broach topics of tribal ethnicity or prejudice explicitly, warning that it might incite conflict and that students would not trust our intent. We therefore avoided asking specific questions about ethnicity and conflicts in our interviews; what we heard along these lines was based on participant teacher knowledge or volunteered in response to open-ended questions. More sustained engagement at a single site with additional local research support might rectify some of these gaps.

Finally, it is unclear how durable intercultural learning effects were beyond the space and duration of the program (a limit indeed shared with many interventionist approaches in CSCW and allied fields). Even when students made mention of intercultural goals, it was unclear whether they internalized changes in underlying attitudes, or merely exhibited temporary or classroom-only

behavioral changes [13, 99]; or indeed, if any of these reported effects could be attributed to the kind of participant response bias familiar to researchers in ICTD and the wider anthropology of development [28]. Some hope for lasting change comes from our interviews two months after Cycle 1 ended however: all 3 students said they had maintained intercultural friendships made in NPP, even one girl who *"didn't expect to make friends with boys."* In future work, we hope to track some of our participants longitudinally, to see whether friendships and attitudinal shifts will persist.

6 CONCLUSION

Intercultural learning is a challenging project, one made more difficult – but all the more important – in the context of the growing multi-ethnic and refugee communities produced by the experience of geopolitical conflict and displacement in a growing number of locations around the world. Whether computer-supported cooperative "work" or "play," as computing education and professions touch more areas of the world, and as world events contribute to ever-increasing multicultural communities, diversity challenges will only multiply. We find that constructionist computing education, accompanied by good pedagogical support, can be a site for effective intercultural learning and collaboration, but also that numerous challenges and pitfalls remain, many only partially addressable through efforts at better technical and pedagogical practice and design. Rather than seeking to overcome or 'solve' such difficulties, future efforts in this space should learn to work creatively with and within these limits, approaching the inevitable frictions, breakdowns and gaps that accompany the work of intercultural learning as resources to be drawn on, leveraged, and deployed.

ACKNOWLEDGMENTS

Research for the Nairobi Play Project was partially funded and supported by UNICEF Kenya. Additional travel funding was provided to the first author by a grant from The Marco Einaudi Center for International Studies and Judith Reppy Institute for Peace & Conflict Studies at Cornell University. The authors would like to thank: Nairobi Play educators and students, Xavier Project staff, the United Nations Alliance of Civilizations (UNAOC), Daniel Baheta, Florian Rabenstein, Jordi Torrent, Mignonne Fowlis, Thomas Dreesen, Tom Heck, Martyn Barrett, Michael Byram, Molly Feldman, Jeremy Fiume, Samir Passi, and our anonymous reviewers for their feedback.

REFERENCES

[1] Konstantin Aal, Marios Mouratidis, Anne Weibert, and Volker Wulf. 2016. Challenges of CI Initiatives in a Political Unstable Situation: Case Study of a Computer Club in a Refugee Camp. In *Proceedings of the 19th International Conference on Supporting Group Work*. ACM, 409–412.

[2] Konstantin Aal, Thomas von Rekowski, George Yerousis, Volker Wulf, and Anne Weibert. 2015. Bridging (Gender-Related) Barriers: A comparative study of intercultural computer clubs. In *Proceedings of the Third Conference on GenderIT*. ACM, 17–23.

[3] Konstantin Aal, George Yerousis, Kai Schubert, Dominik Hornung, Oliver Stickel, and Volker Wulf. 2014. Come_in@ palestine: adapting a german computer club concept to a palestinian refugee camp. In *Proceedings of the 5th ACM International Conference on Collaboration across boundaries: culture, distance & technology*. ACM, 111–120.

[4] International Peace Academy. 1986. *Conflict in Central America: approaches to peace and security.* International Peace Academy.

[5] Morgan G. Ames. 2018. Hackers, Computers, and Cooperation: A Critical History of Logo and Constructionist Learning. *Proc. ACM Hum.-Comput. Interact.* 2, CSCW, Article 18 (Nov. 2018), 19 pages.

[6] Morgan G. Ames and Jenna Burrell. 2017. 'Connected Learning' and the Equity Agenda: A Microsociology of Minecraft Play. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17)*. ACM, New York, NY, USA, 446–457.

[7] Soon Ang and Andrew C. Inkpen. 2008. Cultural intelligence and offshore outsourcing success: A framework of firm-level intercultural capability. *Decision Sciences* 39, 3 (2008), 337–358.

[8] Rahul Banerjee, Leanne Liu, Kiley Sobel, Caroline Pitt, Kung Jin Lee, Meng Wang, Sijin Chen, Lydia Davison, Jason C. Yip, Andrew J. Ko, and Zoran Popovic. 2018. Empowering Families Facing English Literacy Challenges to Jointly Engage in Computer Programming. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18)*. ACM, New York, NY, USA, Article 622, 13 pages.

[9] Jonathan Belman and Mary Flanagan. 2010. Designing games to foster empathy. *International Journal of Cognitive Technology* 15, 1 (2010), 11.

[10] Christine I. Bennett. 1986. *Comprehensive multicultural education: Theory and practice*. Allyn and Bacon Boston.

[11] Milton J. Bennett. 1986. A developmental approach to training for intercultural sensitivity. *International journal of intercultural relations* 10, 2 (1986), 179–196.

[12] Milton J. Bennett. 2009. Defining, measuring, and facilitating intercultural learning: a conceptual introduction to the Intercultural Education double supplement. *Intercultural Education* 20, sup1 (2009), S1–S13.

[13] Bennett M. Berger. 1981. *The Survival of a Counterculture: Ideological Work and Everyday Life Among Rural Communards*. University of California Press.

[14] Leah Buechley, Mike Eisenberg, Jaime Catchen, and Ali Crockett. 2008. The LilyPad Arduino: Using Computational Textiles to Investigate Engagement, Aesthetics, and Diversity in Computer Science Education. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '08)*. ACM, New York, NY, USA, 423–432.

[15] Kenneth David Bush and Diana Saltarelli. 2000. *The two faces of education in ethnic conflict: Towards a peacebuilding education for children*. Technical Report. UNICEF Innocenti Research Centre.

[16] Elizabeth H Campbell. 2006. Urban refugees in Nairobi: Problems of protection, mechanisms of survival, and possibilities for integration. *Journal of refugee studies* 19, 3 (2006), 396–413.

[17] Prudence L. Carter. 2012. *Stubborn roots: Race, culture, and inequality in US and South African schools*. Oxford University Press.

[18] David Paul Cavallo. 2000. *Technological Fluency and the Art of Motorcycle Maintenance: Emergent design of learning environments*. Ph.D. Dissertation. Massachusetts Institute of Technology.

[19] Kathy Charmaz. 2006. *Constructing grounded theory: A practical guide through qualitative analysis*. Sage.

[20] Francesco Checchi, Adrienne Testa, Abdihamid Warsame, Le Quach, and Rachel Burns. 2018. *Estimates of crisis-attributable mortality in South Sudan, December 2013-April 2018*. Technical Report. London School of Hygiene and Tropical Medicine.

[21] Kyungsub Stephen Choi. 2015. A comparative analysis of different gender pair combinations in pair programming. *Behaviour & Information Technology* 34, 8 (2015), 825–837.

[22] Michael Cole. 1998. Can cultural psychology help us think about diversity? *Mind, Culture, and Activity* 5, 4 (1998), 291–304.

[23] Michael Cole, Distributive Literacy Consortium, et al. 2006. *The fifth dimension: An after-school program built on diversity*. Russell Sage Foundation.

[24] David Coulby. 2006. Intercultural education: theory and practice. *Intercultural education* 17, 3 (2006), 245–257.

[25] Jeff Crisp. 2000. A state of insecurity: The political economy of violence in Kenya's refugee camps. *African affairs* 99, 397 (2000), 601–632.

[26] Glauco De Vita. 2005. Fostering intercultural learning through multicultural group work. *Teaching international students: Improving learning for all* (2005), 75–83.

[27] Darla K. Deardorff. 2009. *The SAGE handbook of intercultural competence*. Sage.

[28] Nicola Dell, Vidya Vaidyanathan, Indrani Medhi, Edward Cutrell, and William Thies. 2012. "Yours is Better!": Participant Response Bias in HCI. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12)*. ACM, New York, NY, USA, 1321–1330.

[29] Jill Denner, Linda Werner, Shannon Campe, and Eloy Ortiz. 2014. Pair programming: Under what conditions is it advantageous for middle school students? *Journal of Research on Technology in Education* 46, 3 (2014), 277–296.

[30] Adrienne Dessel and Mary E. Rogge. 2008. Evaluation of intergroup dialogue: A review of the empirical literature. *Conflict Resolution Quarterly* 26, 2 (2008), 199–238.

[31] Sara DeTurk. 2006. The power of dialogue: Consequences of intergroup dialogue and their implications for agency and alliance building. *Communication Quarterly* 54, 1 (2006), 33–51.

[32] Ning Ding, Roel J. Bosker, and Egbert G. Harskamp. 2011. Exploring gender and gender pairing in the knowledge elaboration processes of students using computer-supported collaborative learning. *Computers & Education* 56, 2 (2011), 325–336.

[33] Betsy DiSalvo and Amy Bruckman. 2011. From interests to values. *Commun. ACM* 54, 8 (2011), 27–29.

[34] John A. Dixon and Steve Reicher. 1997. Intergroup contact and desegregation in the new South Africa. *British Journal of Social Psychology* 36, 3 (1997), 361–381.

[35] Sarah Dryden-Peterson and Bethany Mulimbi. 2017. Pathways toward Peace: Negotiating National Unity and Ethnic Diversity through Education in Botswana. *Comparative Education Review* 61, 1 (2017), 58–82.

[36] Michaelanne Dye, Neha Kumar, Ari Schlesinger, Marisol Wong-Villacres, Morgan G. Ames, Rajesh Veeraraghavan, Jacki O'Neill, Joyojeet Pal, and Mary L. Gray. 2018. Solidarity Across Borders: Navigating Intersections Towards Equity and Inclusion. In *Companion of the 2018 ACM Conference on Computer Supported Cooperative Work and Social Computing*. ACM, 487–494.
[37] Susana Eisenchlas and Sue Trevaskes. 2007. Developing intercultural communication skills through intergroup interaction. *Intercultural Education* 18, 5 (2007), 413–425.
[38] Robert M. Emerson, Rachel I. Fretz, and Linda L. Shaw. 2011. *Writing ethnographic fieldnotes*. University of Chicago Press.
[39] Yrjö Engeström. 1987. *Learning by expanding*. Orienta-Konsultit.
[40] Maya Escueta, Vincent Quan, Andre Joshua Nickow, and Philip Oreopoulos. 2017. *Education Technology: An Evidence-Based Review*. Working Paper 23744. National Bureau of Economic Research. https://doi.org/10.3386/w23744
[41] Virginia Eubanks. 2018. *Automating inequality: How high-tech tools profile, police, and punish the poor*. St. Martin's Press.
[42] Karen E Fisher, Katya Yefimova, and Eiad Yafi. 2016. Future's Butterflies: Co-Designing ICT Wayfaring Technology with Refugee Syrian Youth. In *Proceedings of the The 15th International Conference on Interaction Design and Children*. ACM, 25–36.
[43] Jason Freeman, Brian Magerko, Tom McKlin, Mike Reilly, Justin Permar, Cameron Summers, and Eric Fruchter. 2014. Engaging underrepresented groups in high school introductory computing through computational remixing with EarSketch. In *Proceedings of the 45th ACM technical symposium on Computer science education*. ACM, 85–90.
[44] Paulo Freire. 1970. *Pedagogy of the oppressed*. Bloomsbury Publishing USA.
[45] Paul C. Gorski. 2008. Good intentions are not enough: A decolonizing intercultural education. *Intercultural education* 19, 6 (2008), 515–525.
[46] Patricia Gurin, Eric Dey, Sylvia Hurtado, and Gerald Gurin. 2002. Diversity and higher education: Theory and impact on educational outcomes. *Harvard educational review* 72, 3 (2002), 330–367.
[47] Kris D. Gutiérrez, P. Zitlali Morales, and Danny C. Martinez. 2009. Re-mediating literacy: Culture, difference, and learning for students from nondominant communities. *Review of research in education* 33, 1 (2009), 212–245.
[48] Khendum Gyabak and Heriberto Godina. 2011. Digital storytelling in Bhutan: A qualitative examination of new media tools used to bridge the digital divide in a rural community school. *Computers & Education* 57, 4 (2011), 2236–2243.
[49] Kurtis Heimerl, Janani Vasudev, Kelly G. Buchanan, Tapan S. Parikh, and Eric Brewer. 2010. Metamouse: Improving multi-user sharing of existing educational applications. In *Proceedings of the 4th ACM/IEEE International Conference on Information and Communication Technologies and Development*. ACM, 19.
[50] Rebecca Horn. 2010. Responses to intimate partner violence in Kakuma refugee camp: refugee interactions with agency systems. *Social science & medicine* 70, 1 (2010), 160–168.
[51] Andri Ioannou and Chrystalla Antoniou. 2016. Tabletops for peace: technology enhanced peacemaking in school contexts. *Journal of Educational Technology & Society* 19, 2 (2016), 164–176.
[52] Maya Israel, Quentin M. Wherfel, Jamie Pearson, Saadeddine Shehab, and Tanya Tapia. 2015. Empowering K–12 students with disabilities to learn computational thinking and computer programming. *TEACHING Exceptional Children* 48, 1 (2015), 45–53.
[53] Yasmin Kafai. 2018. Constructionist visions: Hard fun with serious games. *International Journal of Child-Computer Interaction* (2018).
[54] Yasmin Kafai and Quinn Burke. 2014. *Connected code: Why children need to learn programming*. MIT Press.
[55] Yasmin Kafai and Quinn Burke. 2015. Constructionist gaming: Understanding the benefits of making games for learning. *Educational psychologist* 50, 4 (2015), 313–334.
[56] Yasmin Kafai, Kylie A. Peppler, and Robbin N Chapman. 2009. *The Computer Clubhouse: Constructionism and Creativity in Youth Communities. Technology, Education–Connections*. ERIC.
[57] Victor Kaptelinin and Bonnie A. Nardi. 2006. *Acting with technology: Activity theory and interaction design*. MIT Press.
[58] Naveena Karusala, Aditya Vishwanath, Arkadeep Kumar, Aman Mangal, and Neha Kumar. 2017. Care as a resource in underserved learning environments. *Proceedings of the ACM on Computer-Supported Collaborative Work* 1 (2017), 1–22.
[59] Neha Katira, Laurie Williams, and Jason Osborne. 2005. Towards increasing the compatibility of student pair programmers. In *Proceedings. 27th International Conference on Software Engineering, 2005. ICSE 2005.* IEEE, 625–626.
[60] UNHCR Kenya. 2018. Kakuma Refugee Camp and Kalobeyei Integrated Settlement. Retrieved August 7, 2019 from http://www.unhcr.org/ke/kakuma-refugee-camp
[61] Elisabeth King and Chrissie Monaghan. 2016. *Peace Education and Peacebuilding in Dadaab Refugee Camp: Results and Lessons Learned*. Technical Report. UNICEF Eastern and Southern Africa Region, Peacebuilding Education and Advocacy Program.

[62] Neha Kumar and Naveena Karusala. 2019. Intersectional Computing. *Interactions* 26, 2 (Feb. 2019), 50–54.

[63] Clifford H. Lee and Elisabeth Soep. 2016. None but ourselves can free our minds: Critical computational literacy as a pedagogy of resistance. *Equity & Excellence in Education* 49, 4 (2016), 480–492.

[64] Keith M. Lewin and Janet S. Stuart. 2016. *Educational innovation in developing countries: case-studies of changemakers.* Springer.

[65] Colleen M. Lewis. 2011. Is pair programming more effective than other forms of collaboration for young students? *Computer Science Education* 21, 2 (2011), 105–134.

[66] Colleen M. Lewis and Niral Shah. 2015. How equity and inequity can emerge in pair programming. In *Proceedings of the eleventh annual International Conference on International Computing Education Research.* ACM, 41–50.

[67] Paul Light, Karen Littleton, Stuart Bale, Richard Joiner, and David Messer. 2000. Gender and social comparison effects in computer-based problem solving. *Learning and Instruction* 10, 6 (2000), 483–496.

[68] Gil Loescher and James Milner. 2005. The long road home: Protracted refugee situations in Africa. *Survival* 47, 2 (2005), 153–174.

[69] Michelle Maiese. 2003. Confidence-Building Measures. *Beyond Intractability* (2003).

[70] Chuei D. Mareng. 2010. Reflections on refugee students' major perceptions of education in Kakuma Refugee Camp, Kenya. *Intercultural Education* 21, 5 (2010), 473–481.

[71] Jane Margolis. 2010. *Stuck in the shallow end: Education, race, and computing.* MIT Press.

[72] Jane Margolis and Allan Fisher. 2003. *Unlocking the clubhouse: Women in computing.* MIT Press.

[73] Rod A. Martin. 2010. *The psychology of humor: An integrative approach.* Elsevier.

[74] Mary Mendenhall, Sarah Dryden-Peterson, Lesley Bartlett, Caroline Ndirangu, Rosemary Imonje, Daniel Gakunga, Loise Gichuhi, Grace Nyagah, Ursulla Okoth, and Mary Tangelder. 2015. Quality education for refugees in Kenya: Pedagogy in urban Nairobi and Kakuma refugee camp settings. (2015).

[75] Jessica Mesmer-Magnus, David J. Glew, and Chockalingam Viswesvaran. 2012. A meta-analysis of positive humor in the workplace. *Journal of Managerial Psychology* 27, 2 (2012), 155–190.

[76] Ariam Mogos, Shamm Petros, and Sarah Giffin. 2016. *The Nairobi Play Project.* Nairobi Play Project. Retrieved August 7, 2019 from http://www.nairobiplay.org/

[77] John Morkes, Hadyn K. Kernal, and Clifford Nass. 1999. Effects of humor in task-oriented human-computer interaction and computer-mediated communication: A direct test of SRCT theory. *Human-Computer Interaction* 14, 4 (1999), 395–435.

[78] Amitabha Mukherjee. 2002. Build Robots Create Science: A Constructivist Education Initiative for Indian Schools. *Proceedings of Development by Design, Bangalore, India* (2002).

[79] Na'ilah Suad Nasir and Sepehr Vakil. 2017. STEM-focused academies in urban schools: Tensions and possibilities. *Journal of the Learning Sciences* 26, 3 (2017), 376–406.

[80] United Nations. 2016. *Sustainable Development Goals Report 2016.* UN.

[81] Marcel Neuenhaus and Maha Aly. 2017. Empathy Up. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems.* ACM, 86–92.

[82] Eko Nugroho. 2018. Board Game for Peace: Integrated Game-Based Learning and Activation Program to Counter Violent Extremism. (2018). Presentation at the Connected Learning Conference, MIT Media Lab, Aug. '18.

[83] Amy Ogan, Vincent Aleven, and Christopher Jones. 2008. Pause, Predict, and Ponder: Use of Narrative Videos to Improve Cultural Discussion and Learning. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '08).* ACM, New York, NY, USA, 155–162.

[84] Joyojeet Pal, Meera Lakshmanan, and Kentaro Toyama. 2007. "My Child will be Respected": Parental perspectives on computers in rural India. In *Proceedings of the International Conference on Information and Communication Technologies and Development (ICTD) 2007.* IEEE, 1–9.

[85] Joyojeet Pal, Udai Singh Pawar, Eric A. Brewer, and Kentaro Toyama. 2006. The case for multi-user design for computer aided learning in developing regions. In *Proceedings of the 15th International Conference on World Wide Web.* ACM, 781–789.

[86] Christina Parker. 2015. *Peacebuilding, Citizenship, and Identity.* Springer.

[87] Sara Pavanello, Samir Elhawary, and Sara Pantuliano. 2010. *Hidden and exposed: Urban refugees in Nairobi, Kenya.* Technical Report. Overseas Development Institute London.

[88] Udai Singh Pawar, Joyojeet Pal, and Kentaro Toyama. 2006. Multiple mice for computers in education in developing countries. In *Proceedings of the Information and Communication Technologies and Development (ICTD) Conference.* IEEE, 64–71.

[89] Thomas F. Pettigrew. 1998. Intergroup contact theory. *Annual review of psychology* 49, 1 (1998), 65–85.

[90] Benjamin Piper, Arbogast Oyanga, Jessica Mejia, and Sarah Pouezevara. 2017. Implementing large-scale instructional technology in Kenya. *International Journal of Education and Development using Information and Communication Technology* 13, 3 (2017), 57–79.

[91] Yula Pulay. 2014. *The Humanizing Power of Shared Humor: Applications to Conflict and Stigma Reduction.* Ph.D. Dissertation. Stanford University.
[92] Jacqueline Reilly and Ulrike Niens. 2014. Global citizenship as education for peacebuilding in a divided society: Structural and contextual constraints on the development of critical dialogic discourse in schools. *Compare: A Journal of Comparative and International Education* 44, 1 (2014), 53–76.
[93] Thomas Reitmaier, Nicola J. Bidwell, and Gary Marsden. 2011. Situating digital storytelling within African communities. *International Journal of Human-Computer Studies* 69, 10 (2011), 658–668.
[94] Mitchel Resnick, John Maloney, Andrés Monroy-Hernández, Natalie Rusk, Evelyn Eastmond, Karen Brennan, Amon Millner, Eric Rosenbaum, Jay Silver, Brian Silverman, et al. 2009. Scratch: programming for all. *Commun. ACM* 52, 11 (2009), 60–67.
[95] Jeremy Roschelle and Stephanie D Teasley. 1995. The construction of shared knowledge in collaborative problem solving. In *Computer supported collaborative learning*. Springer, 69–97.
[96] Omar Ruvalcaba, Linda Werner, and Jill Denner. 2016. Observations of Pair Programming: Variations in Collaboration Across Demographic Groups. In *Proceedings of the 47th ACM Technical Symposium on Computing Science Education*. ACM, 90–95.
[97] Jean Ryoo, Gail Chapman, Julie Flapan, Joanna Goode, Jane Margolis, Christine Ong, Cynthia Estrada, Max Skorodinsky, Tiera Tanksley, Jamika D. Burge, et al. 2019. Going Beyond the Platitudes of Equity: Developing a Shared Vision for Equity in Computer Science Education. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*. ACM, 657–658.
[98] Jean J Ryoo and Linda Kekelis. 2018. Reframing "Failure" in Making: The Value of Play, Social Relationships, and Ownership. *Journal of Youth Development* 13, 4 (2018), 49–67.
[99] Gavriel Salomon and Baruch Nevo. 2005. *Peace education: The concept, principles, and practices around the world*. Psychology Press.
[100] Disa A. Sauter, Frank Eisner, Paul Ekman, and Sophie K. Scott. 2010. Cross-cultural recognition of basic emotions through nonverbal emotional vocalizations. *Proceedings of the National Academy of Sciences* 107, 6 (2010), 2408–2412.
[101] Ari Schlesinger, W Keith Edwards, and Rebecca E Grinter. 2017. Intersectional HCI: Engaging identity through gender, race, and class. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. ACM, 5412–5427.
[102] Kjeld Schmidt and Carla Simonee. 1996. Coordination mechanisms: Towards a conceptual foundation of CSCW systems design. *Computer Supported Cooperative Work (CSCW)* 5, 2-3 (1996), 155–200.
[103] Kai Schubert, Anne Weibert, and Volker Wulf. 2011. Locating computer clubs in multicultural neighborhoods: How collaborative project work fosters integration processes. *International Journal of Human-Computer Studies* 69, 10 (2011), 669–678.
[104] Kimberly A. Scott, Kimberly M. Sheridan, and Kevin Clark. 2015. Culturally responsive computing: a theory revisited. *Learning, Media and Technology* 40, 4 (2015), 412–436.
[105] Arnan Sipitakiat, Paulo Blikstein, and David P. Cavallo. 2004. GoGo board: augmenting programmable bricks for economically challenged audiences. In *Proceedings of the 6th International Conference on Learning sciences*. International Society of the Learning Sciences, 481–488.
[106] Sowmya Somanath, Lora Oehlberg, Janette Hughes, Ehud Sharlin, and Mario Costa Sousa. 2017. 'Maker' within constraints: Exploratory study of young learners using Arduino at a high school in India. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. ACM, 96–108.
[107] Ramón Spaaij and Ruth Jeanes. 2013. Education for social change? A Freirean critique of sport for development and peace. *Physical Education and Sport Pedagogy* 18, 4 (2013), 442–457.
[108] Susan Leigh Star and Karen Ruhleder. 1996. Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information systems research* 7, 1 (1996), 111–134.
[109] Susan Leigh Star and Anselm Strauss. 1999. Layers of silence, arenas of voice: The ecology of visible and invisible work. *Computer supported cooperative work (CSCW)* 8, 1-2 (1999), 9–30.
[110] Gunnar Stevens, Michael Veith, and Volker Wulf. 2003. Come_IN: Using computers to foster the integration of migrant communities. *ACM SIGGROUP Bulletin* 24, 3 (2003), 66–72.
[111] Oliver Stickel, Dominik Hornung, Konstantin Aal, Markus Rohde, and Volker Wulf. 2015. 3D Printing with marginalized children: an exploration in a Palestinian refugee camp. In *ECSCW 2015: Proceedings of the 14th European Conference on Computer Supported Cooperative Work, 19-23 September 2015, Oslo, Norway*. Springer, 83–102.
[112] Sharifa Sultana, François Guimbretière, Phoebe Sengers, and Nicola Dell. 2018. Design Within a Patriarchal Society: Opportunities and Challenges in Designing for Rural Women in Bangladesh. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. ACM, 536.
[113] Reem Talhouk, Ana Bustamante, Konstantin Aal, Anne Weibert, Koula Charitonos, and Vasilis Vlachokyriakos. 2018. HCI and refugees: experiences and reflections. *Interactions* 25, 4 (2018), 46–51.

[114] Divy Thakkar, Nithya Sambasivan, Purva Kulkarni, Pratap Kalenahalli Sudarshan, and Kentaro Toyama. 2018. The Unexpected Entry and Exodus of Women in Computing and HCI in India. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. ACM, 352.
[115] Daniella Tilbury and Ingrid Mulà. 2009. *Review of education for sustainable development policies from a cultural diversity and intercultural dialogue: Gaps and opportunities for future action.* Technical Report. UNESCO.
[116] Kentaro Toyama. 2015. *Geek heresy: Rescuing social change from the cult of technology.* PublicAffairs.
[117] Linda R. Tropp. 2007. Perceived discrimination and interracial contact: Predicting interracial closeness among Black and White Americans. *Social Psychology Quarterly* 70, 1 (2007), 70–81.
[118] Barry Troyna and Richard Hatcher. 2018. *Racism in children's lives: A study of mainly-white primary schools.* Routledge.
[119] Anna Lowenhaupt Tsing. 2011. *Friction: An ethnography of global connection.* Princeton University Press.
[120] R. Unnikrishnan, N. Amrita, Alexander Muir, and Bhavani Rao. 2016. Of Elephants and Nested Loops: How to Introduce Computing to Youth in Rural India. In *Proceedings of the The 15th International Conference on Interaction Design and Children (IDC '16)*. ACM, New York, NY, USA, 137–146.
[121] Sepehr Vakil. 2014. A critical pedagogy approach for engaging urban youth in mobile app development in an after-school program. *Equity & Excellence in Education* 47, 1 (2014), 31–45.
[122] Sepehr Vakil. 2018. Ethics, identity, and political vision: toward a justice-centered approach to equity in computer science education. *Harvard Educational Review* 88, 1 (2018), 26–52.
[123] Sarah J. Van Wart, Sepehr Vakil, and Tapan S. Parikh. 2014. Apps for social justice: Motivating computer science learning with design and real-world problem solving. In *Proceedings of the 2014 conference on Innovation & technology in computer science education*. ACM, 123–128.
[124] Roli Varma. 2010. Why so few women enroll in computing? Gender and ethnic differences in students' perception. *Computer Science Education* 20, 4 (2010), 301–316.
[125] George Veletsianos and Annita Eliadou. 2009. Conceptualizing the use of technology to foster peace via adventure learning. *The Internet and Higher Education* 12, 2 (2009), 63–70.
[126] Sara Vogel, Christopher Hoadley, Laura Ascenzi-Moreno, and Kate Menken. 2019. The Role of Translanguaging in Computational Literacies: Documenting Middle School Bilinguals' Practices in Computer Science Integrated Units. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education (SIGCSE '19)*. ACM, New York, NY, USA, 1164–1170.
[127] Joseph B. Walther. 2009. Computer-mediated communication and virtual groups: Applications to interethnic conflict. *Journal of Applied Communication Research* 37, 3 (2009), 225–238.
[128] Anne Weibert, Mary-Ann Sprenger, Dave Randall, and Volker Wulf. 2016. Lifecycles of Computer Clubs: Rhythms and Patterns of Collaboration and Learning in an Intercultural Setting. In *Proceedings of the 19th International Conference on Supporting Group Work*. ACM, 137–147.
[129] Anne Weibert and Volker Wulf. 2010. All of a sudden we had this dialogue...: intercultural computer clubs' contribution to sustainable integration. In *Proceedings of the 3rd International Conference on Intercultural collaboration*. ACM, 93–102.
[130] Linda L. Werner, Jill Denner, and Steven Bean. 2004. Pair Programming Strategies for Middle School Girls.. In *CATE*. 161–166.
[131] Marisol Wong-Villacres, Arkadeep Kumar, Aditya Vishwanath, Naveena Karusala, Betsy DiSalvo, and Neha Kumar. 2018. Designing for Intersections. In *Proceedings of the 2018 on Designing Interactive Systems Conference 2018*. ACM, 45–58.
[132] George Yerousis, Konstantin Aal, Thomas von Rekowski, David W. Randall, Markus Rohde, and Volker Wulf. 2015. Computer-enabled project spaces: Connecting with Palestinian refugees across camp boundaries. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, 3749–3758.
[133] Craig Zelizer. 2003. The role of artistic processes in peace-building in Bosnia-Herzegovina. *Peace and conflict studies* 10, 2 (2003), 62–75.
[134] Thomas G. Zimmerman, David Johnson, Cynthia Wambsgans, and Antonio Fuentes. 2011. Why Latino high school students select computer science as a major: Analysis of a success story. *ACM Transactions on Computing Education (TOCE)* 11, 2 (2011), 10.

Received April 2019; revised June 2019; accepted August 2019